

Conservation and Transformation of Energy

PS-6 The student will demonstrate an understanding of the nature, conservation, and transformation of energy.

PS-6.11 Explain the relationship of magnetism to the movement of electric charges in electromagnets, simple motors, and generators.

Taxonomy Level: 2.7-B Understand Conceptual Knowledge

Key Concepts:

Electromagnet	Core
Motor	Armature
Generator	Electromagnetic induction

Previous/Future knowledge: In the 6th grade students explain how magnetism and electricity are interrelated by using descriptions, models, and diagrams of electromagnets, generators, and simple electrical motors (6-5.3). In Physical Science students expand their concepts of the relationships of magnetism and electricity. They will develop a concept of electric current and its relationship to magnetism in electromagnets, generators, and simple electric motors.

It is essential for students to understand

- *Electromagnets:*
 - Electric currents in wires produce magnetic fields around the wire.
 - The magnetic field can be concentrated and thus strengthened in several ways:
 - Wrapping the wire in a coil will strengthen the electromagnet. The greater the number of turns in the coil, the greater the increase in strength.
 - Adding a *core* (like iron) will concentrate the magnetic field and strengthen the electromagnet.
 - Increasing the current in the coil will strengthen the electromagnet.
- *Motors:*
 - Electric motors change electrical energy to mechanical energy.
 - Motors contain an electromagnet called an *armature*. When an electric current runs through the wire in the armature it becomes magnetized.
 - The armature spins because other magnets in the motor push and pull the armature and cause it to spin.
 - Motors use the magnetic force from magnets to spin an armature (magnetized by an electric current) and thus change electric energy to mechanical energy.
- *Generators:*
 - A generator changes mechanical energy into electric energy.
 - Generators use electromagnetic induction to produce an electric current.
 - When a wire or a coil of wire moves relative to a magnetic field an electric current can be produced. This process is called *electromagnetic induction*.
 - In a generator at a power plant some other type of energy such as the energy in stream is used to turn a turbine which spins a magnet in a generator. The magnet spins past a coil of wire. This moving magnetic field pushes electrons through the wire.
 - A generator is similar to an electric motor. (A generator is an electric motor working in reverse.)
 - Generators produce AC current.

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It is not essential for students to

- Label the parts of a motor or generator;
- Compare the permeability of different core materials;
- Describe different types of motors or generators;
- Describe the function of a transformer.

Assessment Guidelines:

The objective of this indicator is to explain the relationship of magnetism to the movement of electric charges, therefore, the primary focus of assessment should be to construct a cause and effect model that shows the relationship of electricity and magnetism within electromagnets, motors, and generators.

In addition to *explain*, assessments may require that students:

- Compare motors and generators;
- Summarize major points about electric motors, generators, and electromagnets;
- Summarize electromagnetic induction.
- Identify electromagnets, motors, and generators from illustrations.